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Analysis of Resilience of Business Activities in the Post-Disaster Period of the Chamoli District

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Abstract: The research examines the economic operations' ability to bounce back from a disaster in the Chamoli area of Uttarakhand, with a particular emphasis on the aftermath of the disastrous 2021 flash floods. Natural catastrophes that interrupt operations, infrastructure, and supply networks, like the flash floods caused by a glacier break, provide serious difficulties for nearby enterprises. Based on qualitative information gathered from surveys, field observations, and interviews, this research looks at the methods used by Chamoli enterprises to recover and adjust after the tragedy. The examination of factors influencing business resilience considers the regional socioeconomic context. These factors encompass resource availability, community support, governmental assistance, and adaptability. Furthermore, the role of external entities like foreign aid organizations and non-governmental organizations (NGOs) in bolstering business recovery endeavours is explored. The findings illuminate the resilience strategies adopted by enterprises in Chamoli, including the utilization of traditional knowledge, community networks, supply chain resilience, and diversification of revenue sources.

I. INTRODUCTION

In the aftermath of a disaster, the resilience and employment dynamics of business activities vary across sectors. Numerous factors contribute to sectoral employment and resilience, such as the disaster's severity, preparedness levels, economic structure, and resource availability for recovery efforts. Considerations regarding business resilience in the post-disaster period include various things like Immediate employment impact includes certain sectors may witness a significant decline in employment due to physical damage, supply chain disruptions, or temporary closures post-disaster. Vulnerable industries include tourism, hospitality, retail, and agriculture. Infrastructure and construction encompasses post-disaster recovery often involves substantial investments in infrastructure rehabilitation and reconstruction, creating employment opportunities in the construction sector and related fields.

The resilience of essential services has various sectors providing essential services, like healthcare and utilities, exhibit higher resilience due to prioritized support and funding during recovery phases. Small and medium-sized enterprises (SMEs) face greater challenges in recovery due to limited resources, including financial capacity and access to credit. Targeted government assistance programs can enhance their resilience and employment prospects.

Diversification and interdependence focus on regions with diverse economic bases fare better in disaster resilience. However, interconnectedness between sectors can create vulnerabilities if one sector is significantly affected. Long-term economic restructuring: Major disasters may prompt regions to reevaluate economic activities, leading to shifts in employment patterns and sectoral adaptation. Preparedness and risk reduction include proactive disaster preparedness measures that can minimize job losses and facilitate quicker recovery post-disaster.

It is important to note that specific impacts on sectoral employment and business resilience vary depending on factors like disaster type, geographical location, and existing economic conditions. Policies and strategies to promote resilience, support affected businesses, and stimulate employment are essential for post-disaster recovery and the development of resilient communities.

II. DATA SOURCE & METHODOLOGY

The data collected is of primary in nature. There are fifty respondents who are business entrepreneurs working in the Chamoli district of Uttarakhand. The research focuses on the resilience of business activities. The relative importance is

used to understand each short-term, medium-term, and long-term impact caused by disasters. The same methodology was used to study the risk in UAE highway infrastructure projects. (El-Sayegh, 2015). To assess the impact of disasters and to rank them in the short term, medium term, the relative importance index was applied using the following index

$$\text{Relative Importance Index} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{A * N}$$

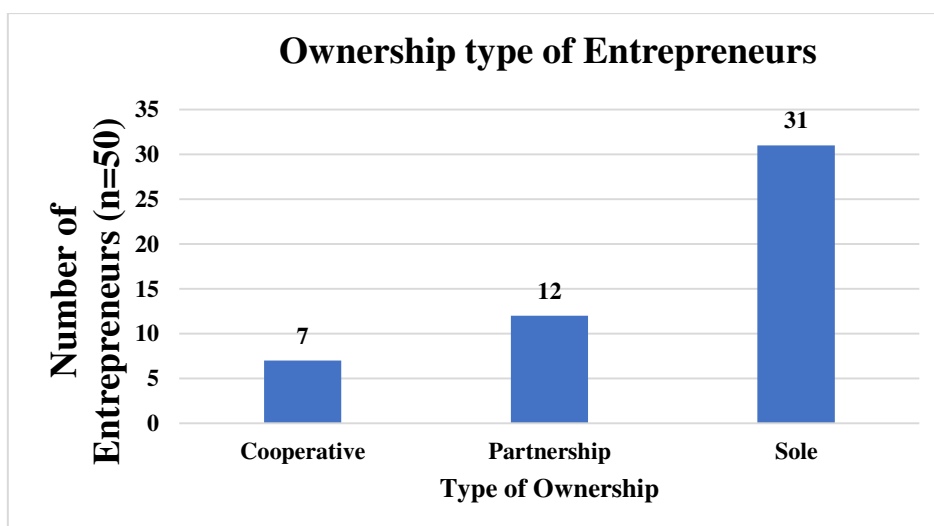
Demographic Variables

Demographic variables observations of the respondents collected through the questionnaire is established in the following table. The data ascertained in the survey includes age, gender, marital status, and organization of the respondents.

Table 1- Demographic Variables

Factors		No of respondents	Percentage of Respondents
Age	20-30	24	48
	31-40	11	22
	41-50	13	26
	50 +	2	4
Gender	Male	42	84
	Female	8	16
Marital Status	Married	41	82
	Unmarried	9	18
Size of Enterprises			
Size of Enterprises based on employees	Micro	50	100
	Small	00	00
	Medium	0	00

Fig 1- Ownership type of Entrepreneurs



Impact of Disasters on Business Activities

Business activities are affected right after the disasters. There is no specific definition to quantify the short-term, medium-term, and long-term periods. To understand the impact on business activities in the post-disaster period, the time period has been classified. The short-term is defined as within 30 days, the medium-term is more than a month and less than 6 months, and the long-term period is defined as a period of more than 6 months.

Level of impact and losses faced by the enterprises in the short term**Table 2- Factors affecting business activities in the short-term**

Short term impacts	Highly Affected	Much affected	Moderately Affected	Slightly Affected	Not Affected
Damage/Loss of Stock	48% 24	22% 11	10% 5	12% 6	8% 4
Disruption in IT services	26% 13	28% 14	18% 9	16% 8	12% 6
Travel difficulties for customers	32% 16	22% 11	20% 10	18% 9	8% 4

To analyze the impact in a short-term period, variables like damage/ loss of stock, disruption of IT services, and travel difficulties for customers are used. The Likert scale was used from 1 to 5 on the following measure

5: Highly affected, 4: Much affected, 3: Moderately affected, 2: Slightly affected. 1: Not affected.

The above table shows that business activities have faced disturbances in the short term and approximately half of the respondents i.e., 48% of the respondents experienced heavy loss/damage to the stock. In the case of disruption in IT services 54% of the respondents were highly to much affected and the same in the case of travel difficulties for customers. 54% of the respondents i.e., 32%, were highly affected and 22% were much affected in terms of access of customers for the services offered by entrepreneurs. To summarise the impact of disasters in the post-disaster period in case of short term, it can be said that most entrepreneurs feel that their business activity gets affected which requires urgent address so that the bare minimum loss is suffered.

Level of impact and losses faced by the enterprises in the medium-term**Table 3- Factors affecting business activities in the medium-term**

Medium-term impacts	Highly Affected	Much affected	Moderately Affected	Slightly Affected	Not Affected
Unavailability of staff	10% 5	16% 8	30% 15	24% 12	20% 10
Disruption of electricity/water supply	20% 10	30% 15	34% 17	10% 5	6% 3
Delay in government action	14% 7	30% 15	22% 11	24% 12	10% 5
Disruption in the supply chain	14% 7	34% 17	24% 12	18% 9	10% 5

As mentioned earlier, we have considered the medium-term period from one month to six months. The variables that were incorporated in the medium term were unavailability of staff, disruption of electricity/ water supply, delay in government action, and disruption in the supply chain. To analyze the impact in a medium-term period, variables like damage/ loss of stock, disruption of IT services, and travel difficulties for customers are used. The Likert scale was used from 1 to 5 on the following measure

5: Highly affected, 4: Much affected, 3: Moderately affected, 2: Slightly affected. 1: Not affected.

The 74% of the respondents were in the moderately to not affected category. The reason can be that people in adverse situations want a source of livelihood. That is why the availability of staff is not disturbed in the post-disaster period. In case of disruption of electricity and water supply, 20% of respondents were highly affected, 30% were much affected and 34% were moderately affected. This indicates that even in hilly areas water supply for household usage is

disrupted. The community is the first responder in times of disaster. The government helps by providing machinery like evacuation teams, ration facilities, etc. For the smooth functioning of business activities, 14% of respondents were not happy with the government's prompt action. Any disaster in the hilly area affects the supply chain in capacity. Those who procure goods and services from distant areas get affected in the post-disaster period in the medium-term period. 14% of the respondents were highly affected and 34% were much affected.

Level of impact and losses faced by the enterprises in the Long-term

Table 4- Factors affecting business activities in the long-term

Long term impacts	Highly Affected	Much affected	Moderately Affected	Slightly Affected	Not Affected
Cash flow	34% 17	24% 12	26% 13	10% 5	6% 3
Infrastructure damage	16% 8	48% 24	18% 9	12% 6	6% 3
Profit	14% 7	42% 21	24% 12	16% 8	2% 1

As mentioned earlier, we have considered the long-term period as more than six months. The variables that were incorporated in the long term were cash flow, infrastructure damage, and profit/ returns. To analyze the impact in a long-term period, variables like cash flow, infrastructure damage, and profit are used. The Likert scale was used from 1 to 5 on the following measure

5: Highly affected, 4: Much affected, 3: Moderately affected, 2: Slightly affected. 1: Not affected.

The cash flow in the local economy plays a very important role in the functioning of the economy. In the long term, 34% of the respondents were highly affected. As far as infrastructure is concerned, 64% of the respondents were in the highly and much-affected category. The infrastructure includes both private and public property. It implies that it takes more than six months to reconstruct or repair the infrastructure in functioning form. As far as returns are concerned, 42% of the respondents felt that their returns/ profits were much affected in the post-disaster period.

Relative Importance Index for impacts and losses faced by the enterprises

The relative importance is used to understand each short-term, medium-term, and long-term impact caused by disasters. To assess the impact of disasters and to rank them, the relative importance index was applied using the following index

$$\text{Relative Importance Index} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{A * N}$$

Were,

n_5 : Strongly agree

n_4 : Agree

n_3 : Neutral

n_2 : Disagree

n_1 : strongly disagree

A: highest weight (in this research, 5 is the highest)

N: Number of respondents

Table 5- RII (Relative Importance Index) of factors affecting business activities in the short run

Short term impacts	Highly Affected	Much affected	Moderately Affected	Slightly Affected	Not Affected	Total	A*N	RII
Damage/Loss of Stock	24	11	5	6	4	195	250	0.78
Disruption in IT services	13	14	9	8	6	170	250	0.68
Travel difficulties for customers	16	11	10	9	4	176	250	0.7

From the above table, the business activities felt short-term losses. The respondents experience damage/ loss to stock, disruption in IT services, and travel difficulties for customers. It is clear from the above table that based on Relative Importance Index Values, the business activities are highly affected by the damage/ loss of stock (0.78) in the post-disaster period, the travel difficulties for customers (0.7), followed by disruption in IT services (0.68).

Table 6- RII of factors affecting business activities in the medium run

Medium-term impacts	Highly Affected	Much affected	Moderately Affected	Slightly Affected	Not Affected	Total	A*N	RII
Unavailability of staff	5	8	15	12	10	136	250	0.54
Loss of electricity/water supply	10	15	17	5	3	174	250	0.69
Delay in government action	7	15	11	12	5	157	250	0.62
Disruption in the supply chain	7	17	12	9	5	162	250	0.64

From the table, based on the relative importance index in the medium-term period, the business activities are highly affected by the disruption in electricity and water supply (0.69). The other variables are disruption in the supply chain (0.64) followed by delay in government action (0.62) and unavailability of staff (0.54).

Table 7- RII of factors affecting business activities in the long run

Long term impacts	Highly Affected	Much affected	Moderately Affected	Slightly Affected	Not Affected	Total	A*N	RII
Cash flow	17	12	13	5	3	185	250	0.74
Infrastructure damage	8	24	9	6	3	178	250	0.71
Profit	7	21	12	8	1	172	250	0.68

The relative importance index of business activities, in the long run, is calculated for variables like cash flow, infrastructure damage, and profits. The highly affected variable was cash flow (0.74) followed by infrastructure damage (0.71) and profits (0.68).

III. CONCLUSION

To conclude, i.e. to analyze the resilience of business activities in the post-disaster period of the Chamoli district, it can be said that there is differentiation of impacts based on time. The stock is highly impacted in the short run whereas electricity and water supply are impacted in the medium run. The problems in the short-run and medium run-can be addressed so that business activities can go back to normal. In the long run cash flow and infrastructure damage are impacted. To address this problem, sustainable infrastructure is needed be it in physical terms or financial infrastructure. In the recent past, digital financial infrastructure has been developed. Over time, things will come into the picture as to what extent this has reduced the problem of cash flow in the post-disaster period.

In the aftermath of the disaster, every household experienced significant loss, both in terms of possessions and loved ones, as the magnitude of the disaster was overwhelming and left no room for escape. The findings of this study highlight a correlation between the lower socioeconomic status (SES) of the population and their limited ability to recover and rebuild. Melissa et al. (2018) discovered a direct relationship between low socioeconomic status and a lack of responsiveness to early warnings. This study further establishes the interconnectedness of low socioeconomic status, vulnerability, and limited resilience, all of which exacerbate each other. Poverty is notably more widespread in

mountainous regions like Chamoli compared to plains, as noted by Gioli et al. (2019), attributing this to poor planning and inadequate data on impoverished populations. Hence, it is imperative to develop a comprehensive database of individuals belonging to the low socioeconomic strata to effectively manage post-disaster impacts. Geographical vulnerability amplifies the challenges, with the most severe consequences borne by those of low SES and impoverished backgrounds. Additionally, the persistence of untouchability exacerbates the situation, leading to exclusion and uncertainty among certain communities. This underscores the need for addressing social issues in disaster-prone hilly areas. Post-disaster society requires a holistic approach, recognizing that both low and high socioeconomic statuses contribute to vulnerability and collapse during and after disasters. Thus, irrespective of socioeconomic status, fostering resilient behaviour is crucial for enhancing community resilience in the face of disasters.

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